Is It Scuzzy Enough?

By Patrick G. Koehler

What is scuzzy? Scuzzy refers to the small computer system Interface (SCSI). SCSI is a parallel interface standard used to connect external hardware such as tape drives, removable drives, external CD-ROMs, etc., to personal computers, Unix systems and Apple Macintosh computers.

SCSI popularity was stifled by the onslaught of new technologies such as Firewire (IEEE 1394) and Universal Serial Bus (USB), but it continues to evolve and is the preferred choice for large servers or systems that support many peripheral devices. SCSI's backward compatibility and legacy support are the principal reasons for its survivability. Powerful computer operating systems using Microsoft Windows, OS/2 and Unix support multithreading and multitasking and helped SCSI devices gain in popularity.

SCSI features support many different components, allow faster data transfer and provide connection for multiple internal and external peripheral devices. Let's examine SCSI standards, characteristics and tips for buying SCSI peripherals. There are three SCSI standards: SCSI-1, SCSI-2 and SCSI-3. SCSI-2 is still in use, but SCSI-3 is the current standard.

A summary of current SCSI options includes:	
SCSI-1	8-bit bus supporting data rates of 4 MBps
SCSI-2	Same as SCSI, but with a 50-pin connector instead of a 25-pin connector to support multiple devices
Wide SCSI	Uses a wider cable (168 cable lines to 68 pins) supporting 16-bit transfers
Fast SCSI	8-bit bus, but doubles the clock rate supporting data rates of 10 MBps
Fast Wide SCSI	16-bit bus supporting data rates of 20 MBps
Ultra SCSI	8-bit bus supporting data rates of 20 MBps
SCSI 3	16-bit bus supporting data rates of 40 MBps. Also referred to as Ultra Wide SCSI

The Shugart Associates System Interface (SASI), a predecessor to SCSI, was developed in 1979. The American National Standards Institute (ANSI) ratified the first standard in 1986 calling it SCSI-1. SCSI-1 did not share a common standard which caused equipment incompatibilities. The first design had a narrow 8-bit bus, slow speed and short cable length. SCSI-1 included a single-ended (SE) transmission supported by a passive termination.

SCSI-2 was the revised, compatible standard, ANSI approved in 1994. A common command set was established so that a Seagate SCSI drive could easily work with an Adaptec SCSI or Western Digital controller. SCSI-2 was a definitive enhancement over SCSI-1. SCSI-2 featured a wider data bus doubling in size from 8- to 16-bit supporting 16 devices. The SCSI adapter takes up one device ID number. A Fast-Wide SCSI-2 can support up to 15 devices because the adapter requires one SCSI ID. SCSI-2 also introduced differential signaling methods: High Voltage Differential (HVD) and Low Voltage Differential (LVD).

HVD and LVD signaling methods increase data transfer speed and lengthen the signal on the SCSI cable. Technology enhancements further evolved SCSI-2 devices by using active and forced perfect termination (FPT) methods. The update added a new command set to support tape drives, CD-ROMs and CDR/RWs. SCSI-2 includes command queuing to allow a server or system to handle multiple requests at the same time, which increases performance for server farms, clusters and Storage Area Networks (SANs). Ultra SCSI-2 and Wide Ultra SCSI-2 increase data performance.

Internet SCSI (iSCSI) transmits data over Internet Protocol (IP). It is a protocol-based standard ratified by the Internet Engineering Task Force (IETF). iSCSI brings a new approach to data storage by using Host Bus Adapters (HBA) that appear to be like a network interface card (NIC) on the network that has its own IP address to communicate. The server then transfers data to the iSCSI device. This transfer is transparent to the user. iSCSI uses the common Ethernet infrastructure to communicate with the server, and it is flexible and easy to maintain.

iSCSI works with the new 10 Gigabit Ethernet standard to perform high speed data transfers, which are much faster than the typical NAS (network-attached storage) or SAN device. There is a security concern with iSCSI. As with other SCSI devices, encryption was not built-in, so a third party device, software or operating system configuration may be required.

Serial Attached SCSI, or SAS, is a recent standard that takes SCSI to new heights with faster data transfer rates that can travel greater distances. SAS brings to the table point-to-point topology using dedicated disk connections with scalable throughput. SAS performance has risen to 3.0 GBps (300 MBps) in 2004, doubling the 1.5 GBps (150 MBps) throughput available for Serial ATA (Advanced Technology Attachment) in 2002. It allows smaller cables for improved air flow while providing fewer signals for high density routing. SAS has good disk and backplane interoperability offering a wide range of deployment options. SAS is less expensive with the added benefit of ATA compatibility, which simplifies the upgrade process and keeps maintenance costs down.

Here are a few tips for selecting SCSI components.

• **Signaling:** Select the correct signaling, considering the distance between your controller and the target device(s). There are three types of signaling methods: SE, HVD and LVD. SE has a much shorter signal range (10 feet) than LVD (40 feet) or HVD (80 feet). The signaling method used is affected by the data bus width and whether it is 8- or 16-bit. The narrow data bus limits the cable length.

An important consideration in picking a SCSI adapter and devices is how long the cable has to be to connect all your SCSI internal and external devices. Length is affected by the data bus width, SCSI standard and whether you are connecting two or more devices. HVD signaling assures of you maximum cable length.

• **Terminating:** There are three types of terminators for SCSI devices: passive, active and FPT. Passive termination is rarely used today because it was designed for low-speed and short distance SCSI-1 devices. Active termination adds voltage regulators to the resistors used in passive termination, which allow more reliable and consistent termination of the bus. FPT eliminates any signal reflections and provides the best form of termination for a single-ended SCSI bus. The SCSI chain must be properly terminated on both ends. Improper termination will cause devices not to be recognized, and you may lose data or have connections that phase in and out.

• **Selecting IDs:** SCSI ID numbers are based on the size of the bus. The 8-bit bus supports 8 devices (0 - 7), the 16-bit bus increases support to 16 devices (0 - 15). The SCSI host adapter requires an ID number and will typically take the last one such as 7 or 15. If you are using a SCSI hard disk, the boot drive will take the first ID, which is 0. You can assign ID numbers to SCSI devices. SCSI plug and play host adapters typically make assigning IDs easy.

The SCSI standard arbitrates or decides which device has control of the bus first. In a narrow bus, the numbers 0-7 would be arranged with 7 being the highest priority and 0 being the lowest. In the case of 16-bit wide data bus, the numbers 0-7 still take a higher priority than the numbers 8-15. So a wide SCSI would have the following numbers from the highest priority to the lowest as 7, 6, 5, 4, 3, 2, 1, 0, 15, 14, 13, 12, 11, 10, 9 and 8.

When manually assigning SCSI devices keeping the boot drive ID as 0 will alleviate any potential problems with older software or hardware. Ensure that all SCSI IDs are different. If you have two SCSI IDs that are the same, only one device will be recognized. You could connect more than one SCSI host adapter to another adapter and connect 8 (or 16) additional devices.

• **Using the right connector:** There are three primary types of connectors. SCSI connectors include Type A (50-pin) for 8-bit SCSI, Type P (68-pin) for 16-bit SCSI and an 80-pin high-density connector called a single connector attachment (SCA) or an SCA-2. SCA, developed for use with Redundant Arrays of Independent Disks (RAID), allows you to replace hot swappable drives in a server while the server is still running. This is important for businesses that cannot afford to have their systems go down.

RAID uses multiple hard disk drives in an array that can be treated as a single logical entity. The series of drives can be formatted and partitioned like a single large, fast drive. This technology can be used to store duplicate copies of data on drives that are exactly the same. If one drive fails, it can be removed and replaced without losing any data.

Mixing narrow and wide SCSI devices can cause problems. First obtain a SCSI host adapter that will support separate segments or channels for connecting both narrow and wide devices. Be careful not to place LVD and SE on the same channel. If you place wide SCSI devices on the same chain as narrow devices, you will not only need a separate connector, but you will also reduce the wide bus throughput to the narrow speed. Narrow SCSI hardware cannot "see" over 7, so if you connect narrow devices to a wide adapter, the other 8 bits will have to be terminated. Use a high byte termination connector to get rid of extra signals so the narrow device can operate on a wide SCSI chain.

SCSI components rank supreme when it comes to connecting multiple devices together such as operating a server farm or setting up a server cluster or central data repository using multiple hard drives. Parallel SCSI is a proven technology with more than 20 years of reliability, flexibility and robustness.

For additional information, go to these Web sites:

√ American National Standards Institute – http://www.ansi.org is the home for ANSI standards. Related SCSI standards such as SAS, SCSI Fibre Channel and more are listed. There is a fee to download ratified SCSI standards .

√ SCSI Trade Association and Serial ATA Working Group – http://www.serialattachedscsi.com and http://www.serialata.org are sites devoted to the new SAS standard.

√ SCSI Source – http://www.scsisource.com for SCSI components, cables, etc.

√ Computer Cable Makers, Inc. – http://www.cablemakers.com for SCSI connectors, adapters, etc.

√ Tech Support Alert – http://techsupportalert.com for information on SCSI installation.

√ Adaptec, Inc. – http://www.adaptec.com/worldwide/support/driverindex.jsp?sess=no for Adaptec SCSI drivers.

√ CNET Networks, Inc. – http://download.com for all types of drivers.

√ DriverGuide.com – http://www.driverguide.com for all types of drivers.

Go to the Department of the Navy Information Technology (DON IT) Umbrella Program contract pages 46 - 51 or Web site at http://www.it-umbrella.navy.mil for savings on hardware, peripheral devices, software and much more.

Koehler is a member of the Technical Specifications & Acquisitions Branch. He has a bachelor's degree in computer information systems and holds certifications in A+, Network+, CCNA, MCDBA 2000, MCP/MCSA/MCSE Windows 2003, MOS Outlook/PowerPoint 2002, Security+ and Server+.